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## The School Museum of Science and Technology for the development of skills

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### Introduction

The Scientific-Technological department of the Mercè Rodoreda Adult Center in Elche (Spain), in the hands of its manager Mr. José T. Pastor, has created a training model that allows the development of students for their social inclusion. The designed model takes into account the development of the following dimensions of the students: academic, personal, social, labour and entrepreneurship. The main element on which this model is based is the School Museum of Science and Technology, a social entrepreneurship organization within the educational center that offers a social service from a global perspective. This educational model has been completed during the last two years thanks to the European project Erasmus + MUSETEAM, which has defined a unique school museum in the world made up of more than 65 pieces and 9 installations created by the students themselves, which allows to optimize science and technology learning and skills development. All this work is digitized and available on the Internet in the “Virtual Museum of Science and Technology” so that it can be used by any educational center from primary to university. The museum is built from the service learning methodology whose objective is the dissemination of science and technology in society, for the students of the center itself (about 1,200 each year) and for any visitor to the museum (in person or through the fairs in which it participates). The MUSETEAM project, in addition to improving the museum, has introduced elements of Emotional intelligence with the intention of enhancing the personal and social development of the students. A starting point that has been completed with elements of Coaching, Mindfulness and Positive Psychology in the training that is taught in all subjects in the Scientific-Technological field. All the work done has allowed the educational model designed to help students develop their key competencies and a set of skills that enable them to achieve their personal, social, academic, labour (or entrepreneurial) goals. An example of didactic innovation that has been developed in our adult center (over 18 years old) and in another secondary and primary school that, for now, has joined this innovation.

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#### Suggested citation:

Pastor Pérez, J. T. (2021). The School Museum of Science and Technology for the development of skills. In S. Sevilla-Vallejo (Ed.), *Teaching and learning in the 21St Century: Towards a Convergence between Technology and Pedagogy*. (pp. 20-28). Madrid, Spain: Adaya Press.

To adapt the training to the needs of its students, a series of research studies were initially carried out in adult centers. These studies concluded the importance of skills-based training in order to carry out 360° training. Based on this idea, different activities were tried until the proposal of the Museum of Science and Technology was consolidated as the best option. This proposal has improved over the last two years thanks to the European Erasmus + project (MUSETEAM) to make the museum the most powerful didactic tool for training based on skills and key competencies for the personal and professional development of students.

## Elements of educative innovation

If we want to create a sustainable society, we need public administration and companies to continually reinvent themselves in order to adapt the service they offer to the citizens' needs. For this, the Mercè Rodoreda Adult Center has developed an innovative educational proposal. An educational model based on the museum that has introduced the following innovative elements into the training:

1. A new organizational modality is created for the museum: "Internal practices". Which allows it, as a social entrepreneurship organization, to have a place in the educational center.
2. It takes into account for its design the students' needs, which become the main objective of the training. This is achieved thanks to research studies carried out in adult training centers.
3. It is based on the idea of learning to learn. The museum completely puts aside the textbook to create a fully project based learning proposal. It is the student himself who seeks the information, creates and shares it with the help of the teacher and his classmates.
4. Offers a proposal for training skills updated to social reality. For this, the museum defines an educational proposal open to society. This is possible by creating the museum as a service-learning project in which learners are responsible for the dissemination of science and technology to society through fairs and open days in which learners participate.

The work developed with all the subjects of the science and technology department (museum included) has introduced the following innovations which have an impact in the learner:

1. Introduce new elements for the development of skills in all the dimensions of the learners. This kind of teaching is not currently contemplated in the specific legislation for the training of adults in the region where the Mercè Rodoreda Center is located. In this sense, the Scientific-Technological department has created some didactic experiences to facilitate the future adaptation of legislation to the new requirements of society.

2. Introduce elements of Emotional Intelligence, Coaching, Mindfulness and Positive Psychology. It can be highlighted the following activities: Related to Emotional Intelligence the activity of Gender Discrimination, to Mindfulness the activity The Minute of Meditation, to Coaching the activity of the Wheel of Life, and related to Positive Psychology the Golden Minute (in which the learner relates his most important outcomes).
3. Create non-formal and informal learning activities. For example: Creation of a kite, visit to the Archena spa, workshops on happiness, "Eating with Mindfulness" activity, visit to a conference on coaching in the University of Alicante, etc.

The educational proposal is creative in different aspects:

1. It is the unique school museum in the world due to the number and interaction capacity of its pieces. The museum itself arises from a creative process resulting from different tests. Once the museum has started, the creation does not stop happening for each of the pieces, installations or activities that are planned in it.
2. The project is open to the outside world and involves Universities, European engineering and training centers and even primary and secondary education centers. It is necessary to build collaboration agreements that are adapted at all times to the needs of each social actor. For example, in collaboration with the Ludor Engineering Center (partner of the MUSETEAM project) a virtual tour has been created that allows the museum to be visited from anywhere in the world ([www.mucyt.es](http://www.mucyt.es)).
3. To disseminate the educational model, the Spanish Network of Science and Technology School Museums has been created ([www.remecyt.es](http://www.remecyt.es)). It includes all the documents prepared for the implementation of the educational model based in the museum. In addition, there is a "Virtual Museum of Science and Technology" where the technical datasheets of all the pieces are located to facilitate that any center can use them to create its own museum.
4. For the introduction of emotional intelligence, Mindfulness, Coaching and Positive Psychology within technical training, different tests had been done. Regarding emotional intelligence, for example, the one that has had the most success has been to delve into emotions to improve relationships and team productivity.

It is a museum for students created by the students themselves. New ideas arise every day that allow us to improve the museum, always based on the creativity required to be the first school museum of these characteristics. All this has made the center a pioneer in the introduction of skills and key competences in adult education.

## **Direct and indirect impact in the learners**

The project has allowed the creation of a School Museum of Science and Technology made up of more than 65 pieces (which are available on the Virtual Museum website [www.mucyt.es](http://www.mucyt.es)) and 9 installations: 1. "The Museum and its Collaborators". 2. "Virtual Mu-

seum of Science and Technology". 3. "Technology in Our Lives". 4. "Chronological Line of Inventions and Inventors". 5. "Weather Station". 6. "The Objects of Science". 7. "Murals of scientists". 8. "Geology". 9. "Biology. This outcome is unique in the world, something of which the center, its teachers and students feel very proud.

With the Museum project the students develop the seven key competences: Communication in their mother tongue (to elaborate the technical documents and presentations), Communication in foreign language (participation in the European projects), Mathematical competence and basic competences in science and technology (developed in 18 areas shown above), Digital competence (to work collaboratively and to share the information through Internet) , Learning to learn (necessary in the applied project based learning methodology), Social and civic competence (developed in the museum as a social entrepreneurship organization) , Sense of initiative and entrepreneurship and Cultural awareness and expression (works the cultural connections to the applied technology used in the region). This outcome makes the museum a project with high impact in the students that makes learning more efficient.

The 18 areas of the museum have pieces and in which the learners can develop their knowledge are: 1. Electrostatics 2. Magnetism 3. Electromagnetism 4. Electromagnetic induction 5. Electric power generators 6. Applications of electromagnetism 7. Renewable energies 8. Optics 9. Mechanisms and automatisms 10. Geology 11. Mechanics 12. Acoustics 13. Electromagnetic fields 14. Electricity 15. Aerodynamics 16. Hydraulics and Fluids 17. Meteorology 18. Biology. This broad learning in science and technology is possible taking into account the point of view that knowledge is something that the student internalizes, different to the traditional concept of memorizing concepts that are only focused to be evaluated in an exam.

All the work developed with the museum allows learners to develop the following skills: 1. Communication skills (assertiveness, negotiation, persuasion); 2. Intrapersonal and interpersonal skills (emotional intelligence, leadership, self-discipline); 3. Analytical and research skills (ability to analyze and process information); and 4. Organizational skills (initiative, teamwork, problem solving, project management, creative thinking, attention to detail). These skills have a direct impact in the personal and labor lives of the students.

The project allows interaction between all the subjects taught in the last year to obtaining the Graduate in Secondary Education. Each of them takes advantage of the museum project to develop some of its contents.

These are the most important indirect results:

- 1) Improve the quality of teaching and learning. This is possible due to the research done and the activities planned to reach the objectives defined by the students. Taking this idea into account make activities make more efficient the process of teacher-learning.
- 2) Improve training through collaborative work. Collaboration takes place: within the group between the members themselves, between the different groups that share information, with other classes through the pieces that are exhibited in the hallways of the center, and through the fairs in which the learners participate.

- 3) Reduce the school dropout. The participation of each student is very important and students are aware of this. On the other hand learning is more directly connected with the live of its students. These ideas make students more engaged with the teamwork focused in the project of the museum.
- 4) Move training out of the classroom is developed, allowing learning from the nearby environment through non-formal learning and informal learning. This is possible because the main objectives planned for the personal development of the students have many connections to activities developed nowadays in society.

The museum helps teachers to introduce non-formal and informal learning in the Science and Technology subject. Each year different informal activities are planned: visits to science and technology museums and presentations in fairs and open days. During the MUSETEAM project some new non-formal activities have been developed: a meeting of collaborators of the museum, new open days, a series of activities in the visit of the European partners to Spain. But the most outstanding event was a training course in Turin (Italy) in which eight learners and three teachers from our center participated. This training has had a decisive impact on the lives of these learners. This is the greatest example of non-formal and informal training within the activities associated to the museum's educational proposal had been developed during these years.

## **The museum as an inclusive project**

The training centers for adults in Spain have social inclusion as their main objective. For this, an important part of the training given is aimed at facilitating the reincorporation of citizens (with few or no studies) to a training that enables them academically. The circumstances that at a certain moment prevented adult training students from completing their studies tend to be maintained over time, so the training given aims to train our students so that they can have a new opportunity to rejoin society. Some of our students are migrant and others are in exclusion risk.

The museum project, as a social entrepreneurship project, adds to the academic training in science and technology the development of skills that allow the students to enter the job market, as well as their personal and social development (fundamental elements for social inclusion that the legislation does not mainly highlight).

Regarding the outside, the museum project has a very important impact on the development of a sustainable society since it covers a space (dissemination of science and technology) that is not usually covered by other social agents. A diffusion that is made in the same language that society speaks, because it is carried out by its own members. This dissemination work is very important to prepare citizens for life in an increasingly technical society.

Finally, it is important to highlight the great effort made by the museum and other subjects of the Scientific-Technological department to promote the development of all dimensions of the students (personal, social, academic, work and entrepreneurship) throu-

gh Emotional Intelligence, Mindfulness, Coaching and Positive Psychology. Fundamental elements to achieve a full life in an increasingly demanding and changing society like the current one.

Some of my students usually ask me, at the end of the course, to offer some extra work that allows them to raise their marks. The tasks they usually do are always varied, but the proposal for them is always the same: develop a material that facilitates the learning of other colleagues. The museum arose from this philosophy as a joint proposal between students and teachers to carry out a work that would serve as learning not only for those who created the piece, but also for all those who visited the museum. Some pieces were created initially, who brought the idea to create a model of teaching-learning process, as a central element for the whole development of the students for their social inclusion. To achieve this, the development of skills was essential, as had been evident in the research studies carried out previously with the aim of knowing the needs of the students. The new museum created as a result of the latest European project MUSETEAM has made possible to give much more force to the development of students' skills and to introduce elements that have improved the project.

Most of the museum pieces are proposed by the students themselves. These, grouped by work teams, make various proposals that are reviewed by the teacher and adapted to the museum's circumstances. Additionally, the collaboration of a large number of social agents and professors has also been received in order to improve the museum's pieces and facilities. I would like to highlight the work of the Masters in Engineering students who have worked in the museum through the collaboration agreements with the University that have developed over the last few years. The museum is open to all those who want to participate in it.

## **The future of the museum**

The museum tries to package in a single educational project all the learning developed in recent years by the center. This began in a European Erasmus + project for teacher training in which a course was carried out in Slovenia to learn how to introduce elements of entrepreneurship within technical training.

Based on the experience acquired in previous European projects, the museum, as a didactic element, had reinforced the work development of the students, but the part of personal and social development required specific attention. From the Scientific-Technological department and from the experience acquired by its manager as Adult Training Advisor, the decision was made to make a decisive contribution in this area. For this, four basic pillars have been defined on which to support the personal and social development of the students: Emotional Intelligence, Coaching, Mindfulness and Positive Psychology. The first pillar (Emotional intelligence) was created through the European project MUSETEAM, for the other three pillars we started to make some contacts among centers from the region. From this work, contact has been made with four other adult training centers in the near area (Elche, Crevillente, Torrevieja) and the Official Language School of Elche.

Among all of them, a consortium has been created that has been accepted for a European Erasmus + project that will take place in the next two courses. Therefore, work on the development of personal and social skills will continue to improve over the next years.

Another important element developed with the MUSETEAM project is to turn the museum into a didactic center element that can be used by different teachers. Proof of the importance of this proposal are the resources received for the installation “Inventions and inventors over time” used in the subject “Interdisciplinary work”; or the installation “Virtual Museum of Science and Technology” used in the “Informatics” subject. This multidisciplinary vision gives the museum proposal a continuity over time because it is not a project of a department but a project of a center.

On the other hand, the fact that it has become a unique element worldwide gives it a value that has received protection and resources for its maintenance from the public administration. In this sense, two years ago it received an endowment of cabinets that have allowed it to create two new facilities and that demonstrate the importance that this educational innovation project has in the region.

To disseminate science and technology, it is intended that other educational centers can also use this didactic element and to achieve this, the Spanish Network of School Museums of Science and Technology has been created ([www.remecyt.es](http://www.remecyt.es)). Thanks to the work carried out through this network, another primary and secondary school (School “Nuestra Señora del Carmen” from San Juan de Alicante) has created its own school museum. It is expected that other centers, thanks to the dissemination of the work carried out, will be able to create their own museums of science and technology or other areas.

The construction of a science and technology museum is very simple in secondary education centers since there is a technology subject in which there is a considerable amount of time and material for the realization of pieces. This would help to run a proposal in which the development of skills is very simple because applied work is carried out. And finally, it would also facilitate the collaboration of different subjects with each other, an identified best practice in education. It would only be necessary the agreement between the science and technology teachers to coordinate their agendas. The whole process is shown on the REMECYT page.

The development of students through Emotional Intelligence, Coaching, Mindfulness and positive Psychology is also an element to be disseminated. The experiences and research work developed by the Mercè Rodoreda Adult Center, as well as all the work that is intended to be carried out with the consortium in the European Erasmus + project will continue be applied and disseminated by the Scientific-Technological department.

## **Partners of the museum**

The museum’s main national partner so far has been the Miguel Hernández University of Elche. Multiple agreements and activities have been carried out together. Our center began by participating in actions to disseminate science and technology organized by the University, later it was the Mercè Rodoreda students themselves who were in charge

of the dissemination. As a result of these first contacts, university students, through four “Osmosis” projects and one “Implica” project, have collaborated in the improvement of the Museum. Throughout all this time, Professor D. José T. Pastor has participated in different events of dissemination of good educational practices in which his experience has been shared with other professors and students of the university.

The museum project has received the support of the public administration thanks to the provision of cabinets received in 2019, which has allowed the creation of two new facilities: “The objects of science” and “Technology in our lives.”

The most important international partner is the European Union. Which has financed the latest projects thanks to which the Scientific-Technological department has improved its experience over the last few years. Specifically, the MUSETEAM project has allowed the museum to have the collaboration of three other key partners: the Villaverde Adult Training Center from Madrid, the Ludor Engineering Research and Engineering Center from Romania and the Euroform Training Center from Italy.

As a result of the activities organized for the MUSETEAM project, other centers have also been contacted: Archaeological Museum of Alicante (MARQ), Didactic Museum of Orihuela (MUDIC), Center for Training, Innovation and Educational Resources (CEFIRE), Museum of the Arts and Sciences of Valencia, Elche City Council, etc.

The closing ceremony of the MUSETEAM European project had the collaboration of the Carlos III University of Madrid, as well as the administration of the Autonomous Community of Madrid. In this act the prizes of the contest designed for the best piece for a school museum of science and technology were awarded. The jury of which was made up of members of the Autonomous University of Madrid, the Royal Academy of Natural and Exact Sciences, the Higher Center for Scientific Research (CSIC) and the Museum of Arts and Sciences from Valencia.

Other adult centers in Madrid also participated in this event, holding an exhibition of science and technology pieces (CEPA Tetuán, Casa de la Cultura de Getafe, Centro Gloria Fuertes de Navalcarnero, etc.). Work continues with all these organizations, since the relationship is a mutual enrichment.

Finally, the latest European Erasmus + project that is starting now has put the five members of the consortium in contact (the three adult centers “La Lonja” from Elche, “El Puntal” from Crevillente, “Torrevieja” adult center and the Official Languages School of Elche) for the introduction of Emotional Intelligence, Coaching, Mindfulness and Positive Psychology in the training of adults.

## **Conclusion**

The work carried out to adapt the needs of the students who attend adult training centers has required a great effort during the recent years. Many activities have been tested, some of which have continued and others have been eliminated. From the learning developed, I would highlight the following:



1. It is very important that educational innovations are simple to put into practice, both for teachers and for students.
2. The number of activities that students have to carry out must be simple. They must be few, but very effective. They also should require very little work from the students outside the educational center. In a way that allows them to reconcile their personal / work life with the academic one.
3. It is necessary that the activities are developed to mobilize positive emotions, so that they facilitate the acquisition of knowledge and reduce school dropouts.
4. With regard to the design of activities for the development of personal and social competencies (based on Emotional Intelligence, Mindfulness, Coaching and positive Psychology), it is essential that they be included within the subjects themselves to make learning more efficient.

Lifelong learning is a fundamental element in the development of today's society. In the case of Spain, the training of adults began with the objective of making society literate, later it has focused on offering a second chance to students who did not get basic studies. But it is necessary at this time to expand it to a training offer with a global dimension. The centers have to be updated and the work carried out at the Mercè Rodoreda Adult Center is a model of educational innovation for other centers. For the project it would be positive to spread the experience out of our center and become known and serve as inspiration for others. It would be a great success if other centers could create their own museum and share pieces between centers. But above all, that they institute the culture of listening to the needs of their students and transfer it to the training.

## References

- Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa (LOMCE), por la que se modifica la Ley Orgánica 2/2006, de 3 de mayo, de Educación. *BOE num 295*, de 10 de diciembre de 2013. Doi: <https://www.boe.es/buscar/pdf/2013/BOE-A-2013-12886-consolidado.pdf>
- Ley Orgánica 2/2006, de 3 de mayo, de Educación (LOE). *BOE num 106*, de 4 de mayo de 2006. doi: <https://www.boe.es/eli/es/lo/2006/05/03/2/con>
- Pastor Pérez, J. T. (2014). Design of adult secondary studies from the perspective of the needs and objectives of its students. Basic skills, complementary skills, and academic contents. *ICERI2014 Proceedings* (pp. 5309-5316). IATED Academy. Doi: <http://library.iated.org/view/PASTORPEREZ2014DES>
- Pastor, J. T. (2018). El Museo Escolar de Ciencia y la Tecnología como proyecto de aprendizaje-servicio. En *Monográfico Innovación UMH 2017*, pp. 122-127. Editorial electrónica UMH. Doi: <http://innovacionumh.es/editorial/MONOGRAFICO%20INNOVACION%20UMH%202017.pdf>

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